

FIGHT'S ON!

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Revolution in Joint Terminal Attack Control Training

Ground-based training for Joint Terminal Attack Control (JTAC)

operators will never be the same thanks to a revolutionary blend of government-off-the-shelf (GOTS) and commercial-off-the-shelf equipment known as the JTAC Virtual Trainer (VT). The Joint Close Air Support (JCAS) research and development (R&D) team of scientists, engineers, and subject-matter experts (SME) collaborated with sister-Service and industry partners to showcase the JTAC Training and Rehearsal System (TRS) VT Dome and Instructor Operating Station (IOS) at AFRL Mesa.

Using a holistic approach, the JCAS R&D team is guided by the



Lt Col "Chachi" Motz, 103rd FS, Willow Grove ARS, PA checks the Ft. Irwin Military Reservation "god's eye" view while conducting JCAS attacks in AFRL Mesa's DMO trial connecting the JTAC TRS Dome to a virtual A-10

Joint Requirements Oversight Council-approved Joint Operational Requirement



Inside the JTAC TRS Dome at AFRL Mesa, MSgt John Lowry, 1st Corps (Ft Lewis WA) TACP NCOIC, and TSgt Richard Schleckser, 1st Cav (Ft Hood TX) JTAC Standardization/Evaluation, demonstrate how the untethered emulated M-22 binoculars, MK VII laser range finder (on TSgt Schleckser), and actual PRC 117F radio enable real-time interaction with virtual and constructive forces

Document and Mission Essential Competency (MEC) survey analysis by JTAC SMEs. The team partnered with Air Support Operations Center (ASOC), Direct Air Support Center (DASC), Special Tactics Squadron (STS), and Tactical Air Control Party (TACP) SMEs from all Services to endorse training and system requirements.

As a proof-of-concept, the first JTAC TRS Dome and IOS are ready to support mission training, rehearsal, and performance assessment for JTAC teams in the Live, Virtual, and Constructive (LVC) environment of Distributed Mission Operations (DMO).

Armed with DMO capability, the JTAC TRS will augment training with MEC-based scenarios designed to ingrain high-order competencies in pre-mission planning, mission planning and coordination, effects-based targeting and weapons evaluation, attack control, and mission assessment.

While orchestrating violence, the JTAC follows Rules of Engagement designed to ensure associated risks are minimized while executing JCAS missions. The JTAC TRS enables realtime visual and electronic interaction in a synthetic hostile environment with SME supervision via the IOS.

Subsequently, MEC-based scenarios will increase JTAC proficiencies by "raising the training bar" for all skill levels at much lower costs and much higher realism than using increasingly sparse live combat air assets on ranges with constricted weapons release limitations.

Although lacking a Systems Program Office (SPO), the JTAC TRS is part of the FY2008-2012 Program Objective Memorandum funding for Air Support Operations Squadron (ASOS) and STS mission needs. The JTAC TRS program is a four-spiral R&D effort, with the JTAC VT and JTAC toolkits representing the first two of several planned



1Lt Joe Gross, 6 Combat Training Squadron/AGOS, and 1Lt Kevin Hill, JCAS R&D team lead, orchestrate scenarios to provide fully immersive JTAC proficiency training using the GOTS interactive NGTS from the JTAC TRS Dome IOS at AFRL Mesa

developments. The JTAC VT and JTAC toolkits at AFRL Mesa form the blueprint for an identical system at the Air Ground Operations School (AGOS) at Nellis AFB NV. Once in place, this second system will support AGOS training and serve as an additional JCAS R&D Testbed.

The effort to integrate more untethered (unencumbered by extraneous connections) toolkits and explore scalable IOS enhancements, as well as software and hardware options, will continue through the next spirals. JTAC TRS software is “shrink to fit” scalable to reduce system size requirements, and spiral three will target a deployable Garrison/Mobile partial-visual system for ASOS and STS units at home base or in the field. Spiral four is slated to meet immediate mission rehearsal needs, and the JTAC TRS software will drive a Helmet Mounted Display (HMD) mated with a Tactical Laptop.

In addition to serving as a networked platform during real-time large force DMO events, the JTAC TRS is augmented by the physics-based Next Generation Threat System (NGTS) to also enable realistic stand-alone training. Warfighters on the IOS can influence JTAC learning

by processing and servicing doctrinally sound artillery Call-For-Fire (to include target marking and Suppression of Enemy Air Defense), requests for JCAS, fighter check-in, and 9-lines. The IOS operator can also inject NGTS constructive Blue and Red forces such as combat aircraft, ground forces, and surface-to-air threats, through the GOTS software developed at AFRL Mesa.

With incomparable ground-based training capability, JTACs can employ their Battlefield Air Operations (BAO) or TACP Close Air Support System (TACP CASS) toolkits in the fully immersive high fidelity 360 x 180 degree field of view dome or the semi-immersive deployable JTAC VT follow-on systems. A combination of untethered actual or emulated BAO or TACP CASS equipment enables warfighters to employ encrypted radio communications (AN/PRC-117F &

148), binocular visual acquisition (M-22), Laser Range Finder (MK VII), Global Positioning System (PSN-11 or 13), and Tactical Laptops.

On a broader scale, the JTAC TRS will integrate with the Joint Theatre Air Ground Simulator System (JTAGSS), the DMO-capable Joint Command and Control (C2) component, to “plug into” critical chain of command assets for on-demand realistic JTAC training. During JTAGSS development, embedded intelligent agents, voice-to-voice, and network system architecture technologies will facilitate training and rehearsal for all ASOC, DASC, TACP, Fire Support Element, and C2 battle staff warfighters.

The intricacies of the JTAC TRS and JTAGSS programs require an overarching SPO-level champion, and ASOS and STS customers plan to fund these programs to deliver unprecedented training capability for the JTAC, ASOC, and DASC warfighter. As the R&D engine for Combat Air Force (CAF) mission needs, AFRL Mesa is raising expectations for USAF and sister-Service warfighters while proving the next generation in readiness training capabilities will be ready for tactical employment, on time and on target.



1Lt Gross and Maj “Sticks” Martin, Distributed Training Ops Center (Iowa ANG), “fly through” a JCAS mission with the newly developed JTAC TRS Brief/Debrief system, which enables unrestricted IOS After Action Reviews from any desired eye point

Training Research: Objective and Subjective Measures of Performance

Two USAF Weapons School (USAFWS) squadrons took a week out of their live-fly Weapons Instructor Course (WIC) at Nellis AFB to immerse their students in high-fidelity multi-bogey, multi-group DMO training research

CAF's wartime capabilities as weapons, platforms, and tactics change to meet evolving threats.

USAFWS instructors have also helped AFRL Mesa scientists and SMEs refine the Performance Evaluation Tracking System (PETS) to support objective in-depth analysis for archival studies and provide immediate mission debrief tools. PETS software pulls up to 1.8 million datapoints per minute from the F-16 Multi-Task Trainer four-ship networked to the Weapons Control Station, parsing the data into cogent outputs derived from numerous variables. The majority of these variables are used for

statistical analysis, including key information warfighters need during debriefings, such as 3-dimensional aircraft position, acceleration, and velocity, positions relative to other aircraft, flight communications, and missile shot parameters. Blue and Red Air shot summaries, key to individual and team assessment, go deeper into each aircraft's entity state at missile launch.

AFRL Mesa SMEs provide subjective assessments while accompanying each USAFWS team during flight briefs, missions, and debriefs. SMEs also use an electronic tablet with the Mobile Operational Measurement System (MOMS) software to make inputs based on the flight's objectives for the period, their performance during mission execution, and their assessment of mission effectiveness during debriefs. MOMS and PETS tools ensure AFRL Mesa scientists have robust objective and subjective measures of performance as solid foundations for peer-reviewed technical reports and presentations to various research symposia and conference venues.



Lt Col "Simple" Symons describes how SMEs use MOMS to collect subjective data to three USAF Scientific Advisory Board members, (from left) Maj Gen George Harrison (USAF-retired), Dr. Peter Worch, and Dr. Mica Endsley, and Dr. Wink Bennett, who leads the AFRL Mesa research team

scenarios at AFRL Mesa. Nine Air Battle Manager (ABM) instructors from the 8th Weapons Squadron (WPS) brought six WIC Class 05B students to support 10 F-16 instructor pilots from the 16th WPS and their 10 WIC Class 05B students for the 5-ride DMO syllabus designed to support USAFWS requirements and several AFRL Mesa training research programs. The close relationship with the USAFWS ensures leading-edge R&D is ready to provide training technologies and methods to improve the



Air Commodore Bob McAlpine, RAF Strike Command Ops Training, discusses the value of AFRL Mesa's DMO research with pilots from Cannon AFB NM, the 524 FS "Hounds of Heaven," and Wing Commander Mike Dobson, the UK's lead for distributed simulation

BRIEFS AND DEBRIEFS

✈ The Division's **Air and Space Operations Center (AOC) training research** team delivered a performance measurement tool for use by the 505th Command and Control Wing instructors during the 2005 Blue Flag exercise at Nellis AFB. Evaluators used the tool to make quantitative assessment how personnel assigned to the Dynamic Targeting Cell performed their mission during intense operations. The AOC

researchers validated human performance metrics and received positive feedback on usability of tool from the C2 experts.

✈ The Division recently consolidated its Joint Worldwide Intelligence Communications System (JWICS) interconnectivity with the Secure Internet Protocol Router Network (SIPRNet) circuit at AFRL Mesa. Via Tactical Local Area Network Encryptor systems, JWICS

via SIPRNet enables further progress of **AFMC's Sensitive Compartmented Information Network (SCINet) Consolidation Project**. This fusion reduced AFMC's annual line leasing costs by more than \$15K and provides scientists and engineers classified networking access at a higher speed.

Fly by Night R&D Integration

After a one year effort of intense coordination with industry, the Fly by Night R&D team secured bi-ocular eyetracker systems for the Night Vision Training System (NVTS). This technology will allow scientists to unobtrusively track head and eye movements while warfighters scan both the Night Vision Goggle (NVG) scene on the HMD and aircraft instruments below the HMD.

The NVTS “nogs” on the HMD are placed approximately 25mm from the warfighter’s eyes, and the bi-ocular system is calibrated to track the left eye HMD during NVG-aided simulated out-the-window viewing and to track the right eye for unaided visual scans. The eye tracking mechanism uses a small, non-visible, low-powered Infra-Red (IR) reference beam and captures in real-time pupil size, eye movement, eye point-of-regard, and corneal reflections. This information can be recorded for DMO scenario debriefs. Video imagery of the HMD and instrument scenes

are displayed side-by-side by a scan converter projected on the same monitor. The data will allow researchers to ascertain specific NVG crosscheck styles for various scenarios.

NVTS produces simulated imagery by accurately capturing reflectivity and lighting of objects in the database as they



Maj Bryan Martyn, Chief, AFRL Mesa Night Operations Center of Excellence, demonstrates the bi-ocular eye tracking equipment attached to the existing helmet-mounted NVG simulation system

would appear through an actual Night Vision Imaging System (NVIS). NVTS components amplify simulation of the spectral range of NVG sensitivity by accounting for light differences from lunar phases and angles, and by adjusting gain response to natural and cultural light sources. By integrating NVTS sensor host software, HMD, and head/eye trackers, NVTS delivers high-fidelity functionality from the material-coded object information (radiometric reflectivity characteristics) in the simulator database.

AFRL Mesa plans to add this unique data collection output to PETS, enabling researchers supporting the USAF Spatial Disorientation Countermeasures Program to study objective and subjective measures of performance during NVG operations in the highly realistic NVTS environment. NVTS has been transitioned to many mission simulators of the US Navy and USMC, and most recently to USAF’s Network Training Center-Luke.



TARGETS OF OPPORTUNITY

✈ Using Director’s Fund assets in a special program, the Division completed a key milestone test of LVC integration using the **Joint Tactical Information Distribution System (Link-16) at AFRL Mesa**. A Link-16 picture from a Joint Range Extension was converted from J-series messages to the Distributed Interactive Simulation protocol and fed into a cockpit loaded with the Common Configuration Implementation Program Operational Flight Program software. The simulator displayed the Link-16 data on the cockpit Horizontal Situation Display and proved to be a significant first step in bringing a true

LVC training transformation to the CAF, key to CSAF’s DMO vision. Next is a demonstration with a live F-16 and AFRL Mesa’s virtual 4-ship of Vipers in late 2005, with full integration and evaluation testing in early 2006.

✈ The F-15 SPO has “seen the light” and supports final engineering to adopt AFRL Mesa’s **Multi-Mode External Lighting System for Aircraft (M2ESA)** for installation in all F-15C Eagles. M2ESA provides programmable NVIS-friendly, Federal Aviation Administration-compliant visible and near-IR emission for night training and operations with

NVGs. Prototype M2ESA devices were installed and successfully demonstrated over a four-month period on two Eagles at Nellis AFB, but the system concept is applicable to many other aircraft types.

M2ESA is an integrated self-contained solid-state system, with each device comprised of a visible light source, a near-IR emitter, and power regulation/voltage discrimination circuitry local to each existing navigation light fixture. The system is designed for rapid installation without requiring wiring changes to the aircraft.



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